



## SEQUENCE LISTING

115  
COPY OF PAPERS  
ORIGINALLY FILED

<110> James E. Galen  
University of Maryland

<120> USE OF CLY A HEMOLYSIN FOR EXCRETION OF  
PROTEINS

<130> UOFMD.007A

<140> 09/993,292  
<141> 2001-11-23

<150> 60/252,516  
<151> 2000-11-22

<160> 19

<170> FastSEQ for Windows Version 4.0

<210> 1  
<211> 6271  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> pSEC84 Expression Plasmid

<400> 1  
gaattctgtg gtagcacaga ataataaaaa gtgtgtaaag aagggtaaaaa aaaaccgaat 60  
gcgaggcatc cggtgaaat agggtaaac agacattcag aaatgaatga cgtaataaa 120  
taaagttaat gatgatagcg ggagttattc tagttgcgag tgaaggtttt gtttgacat 180  
tcagtgtgt caaatactta agaataagtt attgattttt accttgaattt attattgctt 240  
gatgttaggt gcttatttcg ccattccgca ataatcttaa aaagttccct tgcatttaca 300  
ttttgaaaca tctatagcga taaaatgaaac atcttaaaag ttttagtatac atattcgtgt 360  
tggattattc tgcatttttgg gggagaatgg acttgccgac tgattaatga gggtaatca 420  
gtatgcagtgcataaaaaaa gcaaataaaag gcatataaca gatcgatctt aaacatccac 480  
aggaggatgg gatccaaaat aaggaggaaa aaaaaatgac tagtattttt gcagaacaaa 540  
ctgttagaggt agttaaaagc gcgatcgaaa ccgcagatgg ggcatttagat cttataaca 600  
aatacctcga ccaggtcatc cccttggaaaga cctttgatga aaccataaaaaa gagttagcc 660  
gttttaaaca ggagtactcg caggaagctt ctgttttagt tggtgatattt aaagttttgc 720  
ttatggacag ccaggacaag tattttgaag cgacacaaaac tggatgatgg tggtggtg 780  
tcgtgacgca attactctca gcttatattt tactatttga tgaatataat gagaaaaaaag 840  
catcagccca gaaagacatt ctcatttaga tattagatga tggtgcaag aaactgaatg 900  
aagcgcaaaa atctctcctg acaagttcac aaagttcaa caacgcttcc ggaaaaactgc 960  
tggcattaga tagccagttt actaatgattt tttcgaaaaa aagtagttat ttccagtcac 1020  
aggtagat aattcgtaag gaagctttagt ccgggtctgc agccggcata gtcgcccgtc 1080  
cgtttggatt aattatttcc tattcttattt ctgcggcggt gattgaaggaa aaattgattc 1140  
cagaattgaa taacaggcta aaaacagtgc aaaatttctt tactagctt tcaagctacag 1200  
tgaaaacaagc gaataaaagat atcgatgcgg caaaattgaa attagccact gaaatagcag 1260  
caattgggaa gataaaaaacg gaaaccgaaa caaccagatt ctacgttgat tatgtatgattt 1320  
taatgcttc tttattaaaa ggagctgaa agaaaatgat taacacctgt aatgaatacc 1380  
aacaacgtca tggtaagaag acgctttcg aggtcctga cgtcgctagc tgataaaccta 1440  
ggcccgcaaa aaggccagga accgtaaaaa ggccgcgttgc tccataggctt 1500

ccggccccct gacgagcatc aaaaaatcg acgctcaagt cagaggtggc gaaacccgac 1560  
aggactataa agataccagg cgtttcccc tggaaagctcc ctcgtgcgt ctccgttcc 1620  
gaccctgccc cttaccggat acctgtccgc ctttctccct tcggaaagcg tggcgctttc 1680  
tcatacgctca cgctgttaggt atctcagttc ggtgttaggtc gttcgtcaca agctgggctg 1740  
tgtgcacgaa ccccccgttc agcccgaccg ctgcgcctta tccggttaact atcgtcttga 1800  
gtccaacccg gtaagacacg acttatcgcc actggcagca gccactggta acaggattag 1860  
cagagcgagg tatgttaggag gtgctacaga gttcttgaag tggtggccta actacggcta 1920  
caactagaagg acagtatttgc tstatctgcgc tctgctgaag ccagttaccc tcggaaaaaag 1980  
agttggtagc tcttgatccg gcaaacaacaccgcgtggt agcgggtggtt ttttgggtt 2040  
caagcagcag attacgcgcgaaaaaaagg atctcaagaa gatccttga tctttctac 2100  
ggggtctgac gctcgttaga tctaaaacac taggccccaaag agttttaga aacgcaaaaa 2160  
ggccatccgt caggatggcc ttctgcctaa ttgtatgcct ggcagttat ggcgggcgtc 2220  
ctgcccggca ccctccgggc cggtgcctcg caacgttcaa atccgcctcc ggcggatttg 2280  
tcctactcag gagagcggtc accgacaaac aacagataaa acgaaaggcc cagtcttgc 2340  
actgagcct tcgttttatt tgatgcctgg cagttcccta ctctcgcatg gggagacccc 2400  
acactaccat cggcgctacg gcgtttact tctgagttcg gcatggggc aggtgggacc 2460  
accgcgtac tgccgcccagg caaattctgt ttatcagac cgcttctgcg ttctgattta 2520  
atctgtatca ggctgaaaat ttctctcat ccgcacaaac agccaagctg gatctggcaa 2580  
atcgctgaat attcccttttgc tctccgacca tcaggcacct gagtgcgtgt ctgtttcg 2640  
acattcagtt cgctgcgcgc acggctctgg cagtgaatgg ggtaaatgg cactacagggc 2700  
gcctttatg gattcatgca agggaaactac ccataataca agaaaagccc gtcacgggct 2760  
tctcaggcg ttttatggcg ggtctgcstat gtgggtctat ctgactttt gctgttcagc 2820  
agttcctgccc ctctgattttt ccagtctgac cacttcggat tatccgtga caggtcattc 2880  
agactggcta atgcacccag taaggcagcg gtatcatcaa caggcttacc cgtcttactg 2940  
tcaaccggat ctaaaacact agcccaaccc ttcatagaaag gcccgggtgg aatcgaaatc 3000  
tcgtgatggc aggttggcg tcgcttggc ggtcatttcg aaccccaagag tcccgcctac 3060  
aagaactcgt caagaaggcg atagaaggcg atgcgcgtcg aatcgggagc ggcgataaccg 3120  
taaagcacga ggaagcggc agcccatttcg ccgcacaaact cttcagcaat atcacgggta 3180  
gccaacgcata tgctctgata gcccggcc acacccagcc ggcacacgtc gatgaatcca 3240  
aaaaagccgc catttccac catgatattc ggcaaggcagg catcgccatg ggtcacgcacg 3300  
agatcctgcg cgtcggcat gcccggcttgc agcctggcga acagttcggc tggcgcgagc 3360  
ccctgatgtc ttctgtccag atcatctgatc tcgacaagac cggctccat ccgagttacgt 3420  
gctcgctcga tgcatgtttt cgcttgggg tcgaatggc aggttagccgg atcaagcgta 3480  
tgcagccgc gcattgcattc agccatgtatc gatacttttgc cggcaggagc aaggtgagat 3540  
gacaggagat cctgccccgg cacttcggcc aatacgagcc agtcccttcc cgttctactg 3600  
acaacgtcga gcacagctgc gcaaggaacg cccgtcggtt ccagccacga tagccgcgt 3660  
gcctcgcttgc gcagttcatt cagggcaccgc gacaggtcg gtttgcacaa aagaaccggg 3720  
cgccccgtcg ctgacagccg gaacacggcg gcatcagagc agccgattgt ctgttgc 3780  
cagtcatagc cgaatagcct ctccacccaa gcccggag aacctgcgtg caatccatct 3840  
tgttcaatca tgcaaaacgc tcctcatctt gtctctgtat cagatcttgc tcccctgcgc 3900  
catcagatcc ttggcgccaa gaaagccatc cagtttactt tgcagggtt cccacccat 3960  
ccagaggcgccccagctgg caattccggt tcgctgttag acaacatcag caaggagaaa 4020  
ggggctaccg gcaaccaggc agccccctta taaaggcgct tcagtagtca gaccagcatc 4080  
agtccctgaaa aggccggct gcccggcttcc caggttgc acttaccgg ttcgtaaagcc 4140  
atgaaagccg ccacccctt gtgtccgtct ctgttaacggaa tctcgacacag cgatttcg 4200  
gtcagataag tgaatataa cagtgtgaga cacacgatca acacacacca gacaaggggaa 4260  
cttcgtggta gtttcatggc ctcttctcc ttgcgcacaa ggcgtatcctg 4320  
atgtggacta gacataggga tgcctcggtt tggttaatga aaattaactt actacggggc 4380  
tatcttctt ctggccacaca acacggcaac aaaccaccc ttcgtcatga ggcagaaagc 4440  
ctcaaggccc gggcacatca tagcccatat acctgcacgc tgaccacact cactttccct 4500  
gaaaataatc cgctcattca gaccgttccac gggaaatccg tttgtattttt gccgcatcac 4560  
gctgcctccc ggagtttgc tcgacactt ttgttaccgg cccaaacaaaa cccaaaaaca 4620  
acccataccca aaccaataa aacacaaaaa caagacaaat aatcattgtat tgatgggttga 4680  
aatgggttaa acttgacaaa caaaccact taaaacccaa aacataacca aacacacacc 4740  
aaaaaaaaacac cataaggagt ttataaaatg ttgttattca ttgtatgacgg ttcaacaaac 4800

atcaaactac agtggcagga aagcgacgga acaattaaac agcacattag cccgaacagc 4860  
ttcaaacgcg agtggcagt ctctttggg gataaaaagg tctttaacta cacactgaac 4920  
ggcgaacagt attcatttaa tccaatcgcg ccggatgctg tagtcacaac caatatcgca 4980  
tggcaataca ggcacgttaa tgcgtgca gtgcacacg ccttactgac cagtggctg 5040  
ccggtaagcg aagtggatat tggttcaca cttcctctga cagagtatta cgacagaaat 5100  
aaccaccca atacggaaaa tattgagcgt aagaaagcaa acttccggaa aaaaattaca 5160  
ttaaatggcg gggatacatt cacaataaaa gatgtaaaag tcatgcctga atctataccg 5220  
gcaggttatg aagtctaca agaactggat gagtagatt cttaattat tatagatctc 5280  
ggggccacca cattagatat ttctcaggta atggggaaat tatcggggat cagtaaaata 5340  
tacggagact catctcttgg tgcgtctcg gtacatctg cagtaaaaga tgcccttct 5400  
cttgcgagaa caaaaggaaag tagctatctt gtcgacgata taatcattca cagaaaagat 5460  
aataactatc tgaagcaacg aattaatgtat gagaacaaaa tatcaatagt caccgaagca 5520  
atgaatgaag cacttcgtaa acttgagcaa cgtgtattaa atacgctcaa tgaattttct 5580  
ggttatactc atgttatggt tataggcggt ggcgcagaat taatatgcga tgcaaaaa 5640  
aaacacacac agattcgtga tgaacgtttt ttcaaaaacca ataactctca atatgattta 5700  
gttaacggta tgcgtatcat aggttaattaa tgatggacaa ggcgcagaacc attgccttca 5760  
aactaaatcc agatgttaat caaacagata aaattgttg tgatacactg gacagtatcc 5820  
cgcaaggaaa acgaagccgc cttaaacggg ccgcactgac ggcaggtctg gccttataca 5880  
gacaagatcc ccggacccct ttccctttat gtgagctgct gacgaaagaa accacatttt 5940  
cagatatcgtaat gatgtatattg agatcgctat ttccaaaaga gatggccgat tttaattctt 6000  
caatagtccat tcaatcctct tcacaacaag agcaaaaaag tgatgaagag accaaaaaaaa 6060  
atgcgatgaa gctaataaaat taattcaatt attatttgat tccctttatc cactatcagg 6120  
ctggataaaag ggaactcaat caagttat tcttaccagt cattacataa tcgttattat 6180  
gaaataatcg ttgcactgt ctctgttatt caggcaattt caataaaggc acttgctcac 6240  
gctctgtcat ttctgaaac tcttcatgct g 6271

<210> 2  
<211> 305  
<212> PRT  
<213> *Salmonella Typhi*

<400> 2  
Met Thr Ser Ile Phe Ala Glu Gln Thr Val Glu Val Val Lys Ser Ala  
1 5 10 15  
Ile Glu Thr Ala Asp Gly Ala Leu Asp Leu Tyr Asn Lys Tyr Leu Asp  
20 25 30  
Gln Val Ile Pro Trp Lys Thr Phe Asp Glu Thr Ile Lys Glu Leu Ser  
35 40 45  
Arg Phe Lys Gln Glu Tyr Ser Gln Glu Ala Ser Val Leu Val Gly Asp  
50 55 60  
Ile Lys Val Leu Leu Met Asp Ser Gln Asp Lys Tyr Phe Glu Ala Thr  
65 70 75 80  
Gln Thr Val Tyr Glu Trp Cys Gly Val Val Thr Gln Leu Leu Ser Ala  
85 90 95  
Tyr Ile Leu Leu Phe Asp Glu Tyr Asn Glu Lys Lys Ala Ser Ala Gln  
100 105 110  
Lys Asp Ile Leu Ile Arg Ile Leu Asp Asp Gly Val Lys Lys Leu Asn  
115 120 125  
Glu Ala Gln Lys Ser Leu Leu Thr Ser Ser Gln Ser Phe Asn Asn Ala  
130 135 140  
Ser Gly Lys Leu Leu Ala Leu Asp Ser Gln Leu Thr Asn Asp Phe Ser  
145 150 155 160  
Glu Lys Ser Ser Tyr Phe Gln Ser Gln Val Asp Arg Ile Arg Lys Glu

165 170 175  
Ala Tyr Ala Gly Ala Ala Ala Gly Ile Val Ala Gly Pro Phe Gly Leu  
180 185 190  
Ile Ile Ser Tyr Ser Ile Ala Ala Gly Val Ile Glu Gly Lys Leu Ile  
195 200 205  
Pro Glu Leu Asn Asn Arg Leu Lys Thr Val Gln Asn Phe Phe Thr Ser  
210 215 220  
Leu Ser Ala Thr Val Lys Gln Ala Asn Lys Asp Ile Asp Ala Ala Lys  
225 230 235 240  
Leu Lys Leu Ala Thr Glu Ile Ala Ala Ile Gly Glu Ile Lys Thr Glu  
245 250 255  
Thr Glu Thr Thr Arg Phe Tyr Val Asp Tyr Asp Asp Leu Met Leu Ser  
260 265 270  
Leu Leu Lys Gly Ala Ala Lys Lys Met Ile Asn Thr Cys Asn Glu Tyr  
275 280 285  
Gln Gln Arg His Gly Lys Lys Thr Leu Phe Glu Val Pro Asp Val Ala  
290 295 300  
Ser  
305

<210> 3  
<211> 102  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Cloning primer

<400> 3  
ggatccaaaa taaggaggaa aaaaaaatga ctagtatttt tgcagaacaa actgttagagg 60  
tagttaaaag cgcgatcgaa accgcagatg gggcattaga tc 102

<210> 4  
<211> 101  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Cloning primer

<400> 4  
cctaggttat cagctagcga cgtcaggaac ctcgaaaagc gtcttcttac catgacgttg 60  
tttgttattca ttacaggtgt taatcatttt ctttgcagct c 101

<210> 5  
<211> 97  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Cloning primer

<400> 5  
cacggtaaga agacgctttt cgaggttctt gacgtcgcta gctgataacc taggtcatgt 60

tagacagctt atcatcgata agctttaatg cggtagt

97

<210> 6

<211> 69

<212> DNA

<213> Artificial Sequence

<220>

<223> Cloning primer

<400> 6

agatctacta gtgtcgacgc tagctatcag gtcgagggtgg cccggctcca tgcaccgcga 60  
cgcaacgcg 69

<210> 7

<211> 60

<212> DNA

<213> Artificial Sequence

<220>

<223> Cloning primer

<400> 7

actagtcacc cagaaacgct ggtgaaagta aaagatgctg aagatcagtt gggtgcacga 60

<210> 8

<211> 101

<212> DNA

<213> Artificial Sequence

<220>

<223> Cloning primer

<400> 8

cattaaagg t atcgatgat aagctgtcaa acatgagcta gcctaggta ttaccaatgc 60  
ttaatcagtg aggcacctat ctcagcgatc tgtctatttc g 101

<210> 9

<211> 101

<212> DNA

<213> Artificial sequence

<220>

<223> Cloning primer

<400> 9

c gaaaatagac agatcgctga gatagggtgcc tcactgatta agcattggta atgacctagg 60  
ctagctcatg tttgacagct tatcatcgat aaccttaat g 101

<210> 10

<211> 71

<212> DNA

<213> Artificial Sequence

<220>  
<223> Cloning primer

<400> 10  
gcgcactagt aaagaaaacga accaaaagcc atataaggaa acatacggca tttcccatat 60  
tacacgccat g 71

<210> 11  
<211> 103  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Cloning primer

<400> 11  
taaactaccg cattaaagct tatcgatgtat aagctgtcaa acatgacccg ggtcactatt 60  
tgttaactgt taattgtcct tgttcaagga tgctgtcttt gac 103

<210> 12  
<211> 46  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Cloning primer

<400> 12  
tcatgtttga cagcttatca tcgataagct ttaatgcggt agttta 46

<210> 13  
<211> 80  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Cloning primer

<400> 13  
gcccagatct taatcatcca caggaggcgc tagcatgagt aaaggagaag aactttcac 60  
tggagttgtc ccaattcttg 80

<210> 14  
<211> 110  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Cloning primer

<400> 14  
gtgataaact accgcattaa agcttatcga tgataagctg tcaaacatga gcgctctaga 60  
actagttcat tatttgtaga gctcatccat gccatgtgtatcccaagcag 110

<210> 15

<211> 94  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Cloning Primer

<400> 15  
gcgcactagt aaaaaccttg attgttgggt cgacaacgaa gaagacatcg atgttatcct 60  
aaaaaagtct accattctga acttggacat caac 94

<210> 16  
<211> 97  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Cloning Primer

<400> 16  
aactaccgca ttaaagctta tcgatgataa gctgtcaaac atgagctagc ctaggtcatt 60  
agtcgttggt ccaaccttca tcggtcggaa cgaagta 97

<210> 17  
<211> 30  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> Cloning Primer

<400> 17  
cgatgcggca aaattgaaat tagccactga 30

<210> 18  
<211> 8908  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> pSEC84sacB vector

<400> 18  
gaattctgtg gtagcacaga ataataaaa gtgtgtaaag aagggtaaaa aaaaccgaat 60  
gcgaggcatc cggttgaat agggtaaac agacattcag aaatgaatga cggtataaaa 120  
taaagttaat gatgatagcg ggagttattc tagttgcgag tgaaggttt gtttgacat 180  
tcagtgcgtt caaataactta agaataagtt attgattttt accttgaatt attattgctt 240  
gatgttaggt gcttatttcg ccattccgca ataatcttaa aaagttccct tgcatttaca 300  
ttttgaaaca tctatagcga taaatgaaac atcttaaaag ttttagtatac atattcgtgt 360  
tggattattc tgcattttt gggagaatgg acttgccgac tgattaatga gggtaatca 420  
gtatgcagt gcataaaaaaa gcaaataaag gcatataaca gatcgatctt aaacatccac 480  
aggaggatgg gatccaaaat aaggaggaaa aaaaaatgac tagtattttt gcagaacaaa 540  
ctgttagaggt agttaaaagc gcgatcgaaa ccgcagatgg ggcatttagat ctttataaca 600  
aatacctcga ccaggtcatc cccttggaaaga cctttgatga aaccataaaa gagttaagcc 660  
gttttaaaca ggagtactcg caggaagctt ctgttttagt tggtgatatt aaagtttgc 720

ttatggacag ccaggacaag tattttgaag cgacacaaac tgtttatgaa tggtgtggtg 780  
tcgtgacca attactctca gcgtatattt tactatttga tgaatataat gagaaaaaaag 840  
catcagccca gaaagacatt ctcatttagga tattagatga tggtgtcaag aaactgaatg 900  
aagcgaaaa atctctcctg acaagttcac aaagttcaa caacgcttcc ggaaaaactgc 960  
tggcattaga tagccagtttta actaatgatt tttcgaaaaa aagtagttat ttccagtcac 1020  
aggtggatag aattcgtaag gaagcttatg ccggtgctgc agccggcata gtcgcccgtc 1080  
cgtttggatt aattatttcc tattctatttgc ctgcggcgt gattgaaggg aaattgatttcc 1140  
cagaatttggaa taacaggctttaaaaacagttca aaaacagtgc aaaatttctt tactagctta tcagctacag 1200  
tggaaacaagc gaataaaagat atcgatgcgg caaaatttggaa attagccact gaaatagcag 1260  
caattggggaa gataaaaaacg gaaaccggaa caaccagatt ctacgttgc tatgtatgatt 1320  
taatgcttc ttataaaaa ggagctgcaaa agaaaatgtatgaa taacacctgt aatgaataacc 1380  
aacaacgtca tggtaagaag acgctttcg aggttccctga cgtcgctatgaa aagaaaacg 1440  
acccaaaagcc atataaggaa acatacggca ttccctat tacacgccc gatatgctgc 1500  
aaatccctga acagaaaaaa aatgaaaaat atcaagttcc tgaatttgc tgcgtccacaa 1560  
ttaaaaatat ctcttctgca aaaggccctgg acgtttggaa cagctggcca ttacaaaacg 1620  
ctgacggcac tgcgtcaac tatcaccggctt accacatcgt ctgcatttgc gccggagatc 1680  
ctaaaaatgc ggtgacaca tcgatttaca tggttctatca aaaagtcggc gaaacttctt 1740  
ttgacagctg gaaaaacgctt ggcgcgtct ttaaagacag cgacaaatttgc gatgcaatg 1800  
attctatcttcc aaaagaccaaa acacaagaat ggtcaggttc agccacattt acatctgacg 1860  
gaaaaatccg ttatattctac actgatttctt ccggtaaaca ttacggcaaa caaacactga 1920  
caactgcaca agttaacgttca tcagcatcag acagcttttgc gacatcaac ggtgttagagg 1980  
attataatc aatcttgc ggtgacggaa aaacgtatca aatgtacag cagttcatcg 2040  
atgaaggcaaa ctacagctca ggcgacaacc atacgctgag agatcctcac tacgttagaa 2100  
ataaaggcca caaatacttca gtatggaaag caaacactgg aactgaagat ggctaccaag 2160  
gcgaagaatc ttatatttacaa aagcataact atggcaaaag cacatcatttgc ttccgtcaag 2220  
aaagtcaaaa acttctgcaaa agcgataaaa aacgcacggc tgagttacca aacggcgctc 2280  
tcggatgtatgat tgagctaaac gatgattaca cactgaaaaa agtgcgtatggcc ggcgtgatttgc 2340  
catctaacac agttaacagat gaaatttgc ggcgcaacgtt cttaaatttgc aacggcaaaat 2400  
ggtacctgtt cactgactcc cgccgatcaa aatgcgtatgat tgacggcattt acgtctaacg 2460  
atatttacat gcttggttat gtttcttatttcttactgg cccatataaag ccgtgaaca 2520  
aaactggct tggatggaaatggatcttgc atcctaacgc tgtaaccctt attacttac 2580  
acttcgctgtt acctcaagcg gaggaaaca atgtcgatgat tacaagctt atgacaaac 2640  
gaggatttca cgcagacaaa caatcaacgtt ttgcggcaag ctgcgtcttgc aacatcaaaag 2700  
gcaagaaaaac atctgttgc aaagacagca tccttgcaca aggacaatta acagttac 2760  
aatagtgcacc cgggtcatgt ttgacagctt atcatcgata agctttaatg cggttagtttgc 2820  
tcacagttaa attgtcaacg cagtcaggca ccgtgtatgaa aatctaaca tggtctcatc 2880  
gtcatcctcg gcacccgtc cctggatgttgc gtaggcata gcttggttat gccggactg 2940  
ccggccctt tgcggatat cgtccatttgc gacagcatcg ccagtcacta tggcgtctgc 3000  
ctagcgctat atgcgttgc gcaatttcttgc tgccacccg ttctcgagc actgtccgac 3060  
cgcttggcc gcccggcgtt cctgtcgct tcgttacttgc gagccactat cgactacg 3120  
atcatggcga ccacaccgtt cctgtggatc ctctacgccc gacgcacgtt ggcggcatc 3180  
accggcgcca caggtgcggc tgctggcgcc tatatgcgg acatcaccga tggggaaagat 3240  
cgggctcgcc acttcgggtt catgagcgct tggatgttgc tgggtatgtt ggcaggcccc 3300  
gtggccgggg gactgttggg cgcctatcc ttgcgttgc catttccttgc ggcggcggtg 3360  
ctcaacggcc tcaacacttact acttggctgc ttccataatgc aggactgc taaaggagag 3420  
cgtcgaccga tgcccttgc gacccatcaac ccagtcacgtt ccttccgggtt ggcggggggc 3480  
atgactatcg tgcggcact tatgactgtc ttctttatca tgcaactcg aggacaggtt 3540  
ccggcagcgc tctgggtcat ttccggcgag gaccgttcc gctggagcgc gacgtatgtc 3600  
ggcctgtcgc ttgcggatcc cggatcttgc cagccctcg ctcaagccgtt cgttacttgc 3660  
ccggccacca aacgttgc gggatgttgc gacccatcc gccgttgc ggcggacgc 3720  
ctgggtacg tcttgcgttgc ttgcgttgc gggatgttgc tggccttccc cattatgtt 3780  
tttctcgctt ccggccat cggatgttgc gacccatcc gccgttgc caggcaggta 3840  
gatgacgacc atcaggagca gcttcaagga tcgctcgcc ctcttaccag ccttaacttcg 3900  
atcaactggac cgctgtatcg tcaacggcc tttccatcc gggcgacgc atgaaacggg 3960  
ttggcatgga ttgtaggcgc cgcctatcc tttccatcc ggcgttgcgtt 4020

gcatggagcc gggccaccc gacctgatag ctagcgtcga cactagctga taacctaggg 4080  
ccagcaaaag gccaggaacc gtaaaaaggc cgcttgcgt gcttttcc ataggctccg 4140  
ccccctgac gagcatcaca aaaatcgacg ctcaagtcag aggtggcga accccacagg 4200  
actataaaga taccaggcgt ttccccctgg aagctccctc gtgcgtctc ctgttccgac 4260  
cctgccgtt accggatacc tgtccgcctt tctcccttcg ggaagcgtgg cgcttctca 4320  
tagctcacgc tgttagttatc tcaagttcggt gttagtcgtt cgctccaagc tgggctgtgt 4380  
gcacgaaccc cccgttcagc ccgaccgctg cgcccttatcc ggttaactatc gtcttgagtc 4440  
caacccggta agacacgact tatacgccact ggcagcagcc actggtaaca ggattagcag 4500  
agcgaggtat gttaggcggtg ctacagagtt ctgtaaatcgtt tggcctaact acggctacac 4560  
tagaaggaca gtatggta tctgcgtct gctgaagcca gttacccctcg gaaaaagagt 4620  
tggtagctct tgatccggca aacaaaccac cgctggtagc ggtgggtttt ttgtttgcaa 4680  
gcagcagatt acgcccagaa aaaaaggatc tcaagaagat cctttgatct tttctacggg 4740  
gtctgacgt cagtagatct aaaacactag gcccaagagt ttgtagaaac gaaaaaggc 4800  
catccgtcag gatggcccttc tgcttaattt gatgcctggc agtttatggc gggcgtcctg 4860  
ccccccaccc tccggggcgt tgcttcgcaaa cgttcaaaatc cgctccggc ggatttgc 4920  
tactcaggag agcggttacc gacaaacaac agataaaaacg aaaggcccag tcttcgact 4980  
gagccttcg ttttatttga tgcctgcag ttcctactc tcgcatagggg agacccac 5040  
ctaccatccg cgctacggcg tttcacttct gagttcggca tggggtcagg tgggaccacc 5100  
gcgctactgc cgccaggcaaa attctgtttt atcagaccgc ttctgcgttc tgatttaatc 5160  
tgtatcaggc tgaaaatctt ctctcatccg cccaaacacg caagctggat ctggcaaatac 5220  
gctgaatatt cctttgtct ccgaccatca ggacccctgag tcgctgtctt ttctgtaca 5280  
ttcagttcgc tgcgtcaccg gctctggcag tgaatggggg taaatggcac tacaggcgcc 5340  
ttttatggat' tcatgcaagg aaactacca taatacaaga aaagcccgac acgggcttct 5400  
cagggcggtt tatggcggtt ctgctatgtg gtgctatctg actttttgt gttcagcagt 5460  
tcctgcccctc tgatttcca gtctgaccac ttccgattat cccgtgacag gtcattcaga 5520  
ctggctaatg caccagtaa ggcagcggta tcatcaacag gcttaccctg cttactgtca 5580  
accggatcta aaacactagc ccaaccccttca atagaaggcg ggggttggaaat cgaaatctcg 5640  
tgatggcagg ttggcgctcg ctgggtcggtt catttcgaac cccagagtcc cgctcagaag 5700  
aactcgtcaa gaaggcgata gaaggcgatg cgctgcgaat cgggagcggc gataccgtaa 5760  
agcacgagga agcggtcagc ccattcgccg ccaagctctt cagcaatatac acgggttagcc 5820  
aacgctatgt cctgatagcg gtccgcccaca cccagccggc cacagtcgtt gatccagaa 5880  
aagcggccat tttccaccat gatattccgc aacgaggcat cgccatgggt cacgacgaga 5940  
tcctcgccgt cgggcatcg cgcccttgagc ctggcgaaca gttcggctgg cgcgagcccc 6000  
tgatgtctt cgtccagatc atcctgatcg acaagaccgg cttccatccg agtacgtgct 6060  
cgctcgatgc gatgttccgc ttgggtgtcg aatgggcagg tagccgatc aagcgtatgc 6120  
agccgcccga ttgcattcagc catgatggat actttctcg caggagcaag gtgagatgac 6180  
aggagatctt gccccggcac ttccgcctt agcagccagt cccttccgc ttcaatgtaca 6240  
acgtcgagca cagctgcgca aggaacgccc gtctggcca gccacgatag ccgcgtcgcc 6300  
tcgtcctgca gttcattcag ggcaccggac aggtcggtct tgacaaaaag aaccggcgcc 6360  
ccctcgctg acagccggaa cacggcggca tcaagcgcg cgttgcgttgg tttgtcccg 6420  
tcatagccga atagcctctc cacccaaacgc gccggagaac ctgcgtgcaaa tccatcttgc 6480  
tcaatcatgc gaaacgatcc tcattcgttc tcttgatcag atcttgatcc cctgcgccc 6540  
cagatccttgc gccggcaagaa agccatccag ttactttgc agggcttccc aaccttacca 6600  
gagggcgccc cagctggcaaa ttccgggtcg ctgctagaca acatcagcaa ggagaaagg 6660  
gctaccggcg aaccagcagc cccttataaa aggccgttca gtagtcagac cagcatcgt 6720  
cctgaaaagg cgggctcgcc cccgccttca ggttgcgtt taccggattc gtaagccatg 6780  
aaagccgcca cctccctgtg tccgtctctg taacgaatct cgcacagcga ttttcgtgtc 6840  
agataagtga atatcaacag tgtgagacac acgtcaaca cacaccagac aaggaaactt 6900  
cggtggtagtt tcatggcctt ctttccttgc cggccaaacgc ggttgcgtt tttcctgtat 6960  
tggactagac ataggatgc ctcgtgggg ttaatggaaa ttaacttact acggggctat 7020  
cttctttctg ccacacaaca cggcaacaaa ccacccctc acgtcatgggc agaaaaggc 7080  
aagcggccggg cacatcatag cccatatacc tgcacgctga ccacactac tttccctgaa 7140  
ataatccgc tcattcagac cgttccacggg aaatccgtgt gattgttgc gcatcagc 7200  
gcctcccgaa gtttgcgtcg agcactttt gttacccgcca aacaaaaccc aaaaacaacc 7260  
catacccaac ccaataaaac accaaaacaa gacaaataat cattgattga tgggtgaaat 7320

gggttaaact tgacaaacaa acccacttaa aacccaaac atacccaaac acacaccaa 7380  
aaaacaccat aaggagttt ataaatgtt gtttgggtat aaaaaggctt ttaactacac actgaacggc 7440  
aaactacagt ggcaggaaag cgacggaaca attaaacagc acattagccc gaacagctc 7500  
aaacgcgagt gggcagtctc ttttgggtat aaaaaggctt ttaactacac actgaacggc 7560  
gaacagtatt catttgcattcc aatcagcccc gatgctgttag tcacaaccaa tatcgcatgg 7620  
caatacagcg acgttaatgt cggtgcgttg catcacgcct tactgaccag tggctgcgg 7680  
gtaagcgaag tgatattgtt tgacacatt cctctgacag agtattacga cagaaataac 7740  
caacccaaata cgaaaaatat tgagcgtaag aaagcaaact tccggaaaaa aattacatta 7800  
aatggcgaaa atacattcac aataaaagat gtaaaagtca tgcctgaatc tataccggca 7860  
ggttatgaag ttctacaaga actggatgag ttagattctt tattaattat agatctcg 7920  
ggcaccacat tagatatttc tcaggtatg gggaaattat cggggatcag taaaatatac 7980  
ggagactcat ctcttgggtgt ctctctgggt acatctgcag taaaagatgc ctttctctt 8040  
gcfagaacaa aaggaagtag ctatcttgct gacgatataa tcattcacag aaaagataat 8100  
aactatctga agcaacgaat taatgtatgaa aacaaaatatac caatagtcac cgaagcaatg 8160  
aatgaagcac ttctgtttact tgagcaacgt gtattaaata cgctcaatga attttctgt 8220  
tatactcatg ttatggttat aggccgtggc gcagaattaa tatgcgtatgc agtaaaaaaaa 8280  
cacacacaga ttctgtatga acgttttttc aaaaccaata actctcaata tgatttagg 8340  
aacggatgt atctcatagg taattaaatgaa tggacaagcg cagaaccatt gccttcaaac 8400  
taaatccaga tgtaatcaa acagataaaa ttgtttgtga tacactggac agtatccgc 8460  
aaggggaaacg aagccgcctt aaccggcccg cactgacggc aggtctggcc ttatacagac 8520  
aagatccccg gaccctttc ctgtttatgtg agtgcgtac gaaagaaaacc acatttcag 8580  
atatcgtaa tatattgaga tcgcttatttc caaaaagagat ggccgatttt aattcttcaa 8640  
tagtcactca atccctttca caacaagagc aaaaaaggatgaa tgaagagacc aaaaaaaaaatg 8700  
cgatgaagct aataaaattaa ttcaattattt attgagttcc ctatccac tatcaggctg 8760  
gataaaggga actcaatcaa gtttatttct taccagtcat tacataatcg ttattatgaa 8820  
ataatcgttt gcaactgtctc tggttattcag gcaatttcaa taaaggcact tgctcacgct 8880  
ctgtcattttt ctgaaactctc tcatgctg 8908

<210> 19  
<211> 2253  
<212> DNA  
<213> Artificial Sequence

<220>  
<223> ClyA::SacB fusion gene

<221> CDS  
<222> (0) . . . (2253)

<400> 19  
atg act agt att ttt gca gaa caa act gta gag gta gtt aaa agc gcg 48  
Met Thr Ser Ile Phe Ala Glu Gln Thr Val Glu Val Val Lys Ser Ala  
1 5 10 15

atc gaa acc gca gat ggg gca tta gat ctt tat aac aaa tac ctc gac 96  
Ile Glu Thr Ala Asp Gly Ala Leu Asp Leu Tyr Asn Lys Tyr Leu Asp  
20 25 30

cag gtc atc ccc tgg aag acc ttt gat gaa acc ata aaa gag tta agc 144  
Gln Val Ile Pro Trp Lys Thr Phe Asp Glu Thr Ile Lys Glu Leu Ser  
35 40 45

cgt ttt aaa cag gag tac tcg caq qaa qct tct gtt tta gtt gat 192

Arg Phe Lys Gln Glu Tyr Ser Gln Glu Ala Ser Val Leu Val Gly Asp			
50	55	60	
att aaa gtt ttg ctt atg gac agc cag gac aag tat ttt gaa gcg aca			240
Ile Lys Val Leu Leu Met Asp Ser Gln Asp Lys Tyr Phe Glu Ala Thr			
65	70	75	80
caa act gtt tat gaa tgg tgg gtc gtg acg caa tta ctc tca gcg			288
Gln Thr Val Tyr Glu Trp Cys Gly Val Val Thr Gln Leu Leu Ser Ala			
85	90	95	
tat att tta cta ttt gat gaa tat aat gag aaa aaa gca tca gcc cag			336
Tyr Ile Leu Leu Phe Asp Glu Tyr Asn Glu Lys Lys Ala Ser Ala Gln			
100	105	110	
aaa gac att ctc att agg ata tta gat gat ggt gtc aag aaa ctg aat			384
Lys Asp Ile Leu Ile Arg Ile Leu Asp Asp Gly Val Lys Lys Leu Asn			
115	120	125	
gaa gcg caa aaa tct ctc ctg aca agt tca caa agt ttc aac aac gct			432
Glu Ala Gln Lys Ser Leu Leu Thr Ser Ser Gln Ser Phe Asn Asn Ala			
130	135	140	
tcc gga aaa ctg ctg gca tta gat agc cag tta act aat gat ttt tcg			480
Ser Gly Lys Leu Leu Ala Leu Asp Ser Gln Leu Thr Asn Asp Phe Ser			
145	150	155	160
gaa aaa agt agt tat ttc cag tca cag gtg gat aga att cgt aag gaa			528
Glu Lys Ser Ser Tyr Phe Gln Ser Gln Val Asp Arg Ile Arg Lys Glu			
165	170	175	
gct tat gcc ggt gct gca gcc ggc ata gtc gcc ggt ccg ttt gga tta			576
Ala Tyr Ala Gly Ala Ala Gly Ile Val Ala Gly Pro Phe Gly Leu			
180	185	190	
att att tcc tat tct att gct gcg ggc gtg att gaa ggg aaa ttg att			624
Ile Ile Ser Tyr Ser Ile Ala Ala Gly Val Ile Glu Gly Lys Leu Ile			
195	200	205	
cca gaa ttg aat aac agg cta aaa aca gtg caa aat ttc ttt act agc			672
Pro Glu Leu Asn Asn Arg Leu Lys Thr Val Gln Asn Phe Phe Thr Ser			
210	215	220	
tta tca gct aca gtg aaa caa gcg aat aaa gat atc gat gcg gca aaa			720
Leu Ser Ala Thr Val Lys Gln Ala Asn Lys Asp Ile Asp Ala Ala Lys			
225	230	235	240
ttg aaa tta gcc act gaa ata gca gca att ggg gag ata aaa acg gaa			768
Leu Lys Leu Ala Thr Glu Ile Ala Ile Gly Glu Ile Lys Thr Glu			
245	250	255	
acc gaa aca acc aga ttc tac gtt gat tat gat gat tta atg ctt tct			816
Thr Glu Thr Thr Arg Phe Tyr Val Asp Tyr Asp Asp Leu Met Leu Ser			
260	265	270	

tta tta aaa gga gct gca aag aaa atg att aac acc tgt aat gaa tac Leu Leu Lys Gly Ala Ala Lys Lys Met Ile Asn Thr Cys Asn Glu Tyr 275 280 285	864
caa caa cgt cat ggt aag aag acg ctt ttc gag gtt cct gac gtc gct Gln Gln Arg His Gly Lys Lys Thr Leu Phe Glu Val Pro Asp Val Ala 290 295 300	912
agt aaa gaa acg aac caa aag cca tat aag gaa aca tac ggc att tcc Ser Lys Glu Thr Asn Gln Lys Pro Tyr Lys Glu Thr Tyr Gly Ile Ser 305 310 315 320	960
cat att aca cgc cat gat atg ctg caa atc cct gaa cag caa aaa aat His Ile Thr Arg His Asp Met Leu Gln Ile Pro Glu Gln Gln Lys Asn 325 330 335	1008
gaa aaa tat caa gtt cct gaa ttc gat tcg tcc aca att aaa aat atc Glu Lys Tyr Gln Val Pro Glu Phe Asp Ser Ser Thr Ile Lys Asn Ile 340 345 350	1056
tct tct gca aaa ggc ctg gac gtt tgg gac agc tgg cca tta caa aac Ser Ser Ala Lys Gly Leu Asp Val Trp Asp Ser Trp Pro Leu Gln Asn 355 360 365	1104
gct gac ggc act gtc gca aac tat cac ggc tac cac atc gtc ttt gca Ala Asp Gly Thr Val Ala Asn Tyr His Gly Tyr His Ile Val Phe Ala 370 375 380	1152
tta gcc gga gat cct aaa aat gcg gat gac aca tcg att tac atg ttc Leu Ala Gly Asp Pro Lys Asn Ala Asp Asp Thr Ser Ile Tyr Met Phe 385 390 395 400	1200
tat caa aaa gtc ggc gaa act tct att gac agc tgg aaa aac gct ggc Tyr Gln Lys Val Gly Glu Thr Ser Ile Asp Ser Trp Lys Asn Ala Gly 405 410 415	1248
cgc gtc ttt aaa gac agc gac aaa ttc gat gca aat gat tct atc cta Arg Val Phe Lys Asp Ser Asp Lys Phe Asp Ala Asn Asp Ser Ile Leu 420 425 430	1296
aaa gac caa aca caa gaa tgg tca ggt tca gcc aca ttt aca tct gac Lys Asp Gln Thr Gln Glu Trp Ser Gly Ser Ala Thr Phe Thr Ser Asp 435 440 445	1344
gga aaa atc cgt tta ttc tac act gat ttc tcc ggt aaa cat tac ggc Gly Lys Ile Arg Leu Phe Tyr Thr Asp Phe Ser Gly Lys His Tyr Gly 450 455 460	1392
aaa caa aca ctg aca act gca caa gtt aac gta tca gca tca gac agc Lys Gln Thr Leu Thr Ala Gln Val Asn Val Ser Ala Ser Asp Ser 465 470 475 480	1440
tct ttg aac atc aac ggt gta gag gat tat aaa tca atc ttt gac ggt Ser Leu Asn Ile Asn Gly Val Glu Asp Tyr Lys Ser Ile Phe Asp Gly 485 490 495	1488

gac gga aaa acg tat caa aat gta cag cag ttc atc gat gaa ggc aac Asp Gly Lys Thr Tyr Gln Asn Val Gln Gln Phe Ile Asp Glu Gly Asn	1536
500 505 510	
tac agc tca ggc gac aac cat acg ctg aga gat cct cac tac gta gaa Tyr Ser Ser Gly Asp Asn His Thr Leu Arg Asp Pro His Tyr Val Glu	1584
515 520 525	
gat aaa ggc cac aaa tac tta gta ttt gaa gca aac act gga act gaa Asp Lys Gly His Lys Tyr Leu Val Phe Glu Ala Asn Thr Gly Thr Glu	1632
530 535 540	
gat ggc tac caa ggc gaa gaa tct tta ttt aac aaa gca tac tat ggc Asp Gly Tyr Gln Gly Glu Ser Leu Phe Asn Lys Ala Tyr Tyr Gly	1680
545 550 555 560	
aaa agc aca tca ttc ttc cgt caa gaa agt caa aaa ctt ctg caa agc Lys Ser Thr Ser Phe Phe Arg Gln Glu Ser Gln Lys Leu Leu Gln Ser	1728
565 570 575	
gat aaa aaa cgc acg gct gag tta gca aac ggc gct ctc ggt atg att Asp Lys Lys Arg Thr Ala Glu Leu Ala Asn Gly Ala Leu Gly Met Ile	1776
580 585 590	
gag cta aac gat gat tac aca ctg aaa aaa gtg atg aaa ccg ctg att Glu Leu Asn Asp Asp Tyr Thr Leu Lys Lys Val Met Lys Pro Leu Ile	1824
595 600 605	
gca tct aac aca gta aca gat gaa att gaa cgc gcg aac gtc ttt aaa Ala Ser Asn Thr Val Thr Asp Glu Ile Glu Arg Ala Asn Val Phe Lys	1872
610 615 620	
atg aac ggc aaa tgg tac ctg ttc act gac tcc cgc gga tca aaa atg Met Asn Gly Lys Trp Tyr Leu Phe Thr Asp Ser Arg Gly Ser Lys Met	1920
625 630 635 640	
acg att gac ggc att acg tct aac gat att tac atg ctt ggt tat gtt Thr Ile Asp Gly Ile Thr Ser Asn Asp Ile Tyr Met Leu Gly Tyr Val	1968
645 650 655	
tct aat tct tta act ggc cca tac aag ccg ctg aac aaa act ggc ctt Ser Asn Ser Leu Thr Gly Pro Tyr Lys Pro Leu Asn Lys Thr Gly Leu	2016
660 665 670	
gtg tta aaa atg gat ctt gat cct aac gat gta acc ttt act tac tca Val Leu Lys Met Asp Leu Asp Pro Asn Asp Val Thr Phe Thr Tyr Ser	2064
675 680 685	
cac ttc gct gta cct caa gcg aaa gga aac aat gtc gtg att aca agc His Phe Ala Val Pro Gln Ala Lys Gly Asn Asn Val Val Ile Thr Ser	2112
690 695 700	
tat atg aca aac aga gga ttc tac gca gac aaa caa tca acg ttt gcg Tyr Met Thr Asn Arg Gly Phe Tyr Ala Asp Lys Gln Ser Thr Phe Ala	2160

705

710

715

720

cca agc ttc ctg ctg aac atc aaa ggc aag aaa aca tct gtt gtc aaa 2208  
Pro Ser Phe Leu Leu Asn Ile Lys Gly Lys Lys Thr Ser Val Val Lys  
725 730 735

gac agc atc ctt gaa caa gga caa tta aca gtt aac aaa tag tga 2253  
Asp Ser Ile Leu Glu Gln Gly Gln Leu Thr Val Asn Lys \* \*  
740 745